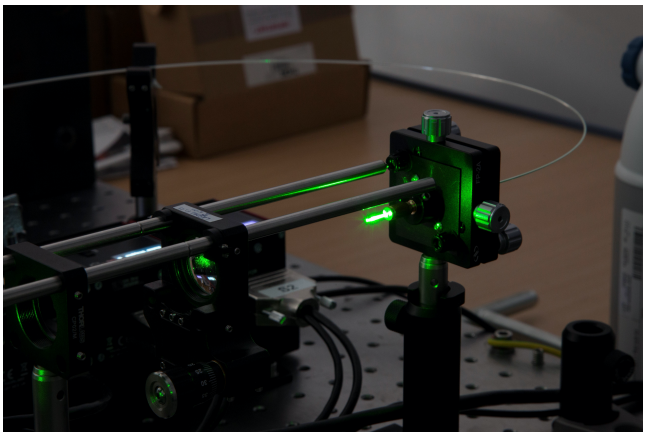
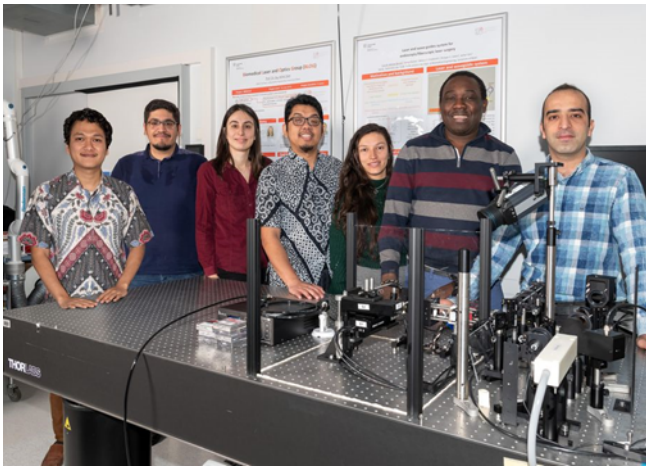
University of Basel

Department of Biomedical Engineering

Biomedical Laser and Optics Group (BLOG)



Fiber-based Laser Surgery System (C. Bosshard)



BLOG team (T. Schürch)

BLOG develops smart devices for medical therapy, diagnostics and monitoring using novel optical technologies. The main research focus of BLOG is to develop a fiber-based laser with feedback systems which guarantee extremely precise cuts of almost all shapes in minimally invasive surgery. The laser and the feedback system will detect the tissue type in front of the tip. To achieve this, the system is needed as well to work as an opto-acoustical and optical feedback system and an optical coherence tomography. Depending on the feedback obtained from the real-time feedback system, the laser continues cutting or immediately stops to avoid damaging vital tissue. The combined system will be called Smart Laser Surgery.

Main projects under development in the BLOG can be listed as:

A) Fiberoptic delivery system
B) Optical feedback system
C) Acoustical feedback system
D) Imaging system based on optical methods

A: Fiberoptic delivery method will be used to send the laser beam along with the endoscope. Since a flexible endoscope design is needed, sequential mirror systems cannot be used.
B-C: Before cutting any vital tissue, an optical and an acoustic feedback system will be used to differentiate the tissue type. Depending on the feedback, the cutting laser will continue cutting or immediately stop.
D: During laser ablation, depth control, and tissue differentiation will be provided from an optical coherence tomography (OCT) which is a high-resolution imaging system. By using OCT not only depth control but also temperature increase in the surrounding tissue will be visualized.

Department of
Biomedical Engineering
Gewerbestrasse 14
CH – 4123 Allschwil
+41 61 207 54 02
news-dbe@unibas.ch
www.dbe.unibas.ch

Funding:

WSS
WERNER SIEMENS-STIFTUNG

Group Leaders:
Dr.-Ing. Azhar Zam
Assistant Professor
azhar.zam@unibas.ch

References:
(1) H. N. Kenhagho et al., "Characterization of Ablated Bone and Muscle for Long-Pulsed Laser Ablation in Dry and Wet Conditions." *Materials* 2019, *12*, 1338.
(2) L. Beltrán et al., *"Optimizing controlled laser cutting of hard tissue (bone).Optimierung von Kontrollierter Laserosteotomie",* at-Automatisierungstechnik, 2018, 66. Jg., Nr. 12, S. 1072-1082.
(3) H. Abbasi, G. Rauter, R. Guzman, P. C. Cattin, A. Zam, "Laser-induced breakdown spectroscopy as a potential tool for autocarbonization detection in laserosteotomy", Journal of Biomedical Optics, Vol. 23, No. 7, p. 071206 (2018).